

CLAIMS

What Is Claimed Is:

1 1. A variable reflectance vehicle mirror which can be controlled to adjust
2 reflectivity, comprising:
3 a super twisted nematic (STN) liquid crystal cell having a front side and a
4 rear side;
5 a first polarization filter positioned on the front side of said STN liquid
6 crystal cell;
7 a second polarization filter positioned on the rear side of said STN liquid
8 crystal cell;
9 a reflective layer positioned adjacent to said second polarization filter; and
10 a control circuit connected to said STN liquid crystal cell for controlling
11 the birefringence of the STN liquid crystal cell to adjust the degree of reflection of the
12 mirror.

1 2. The variable reflectance vehicle mirror of claim 1, wherein said STN
2 liquid crystal cell includes a layer of super twisted nematic (STN) liquid crystal material
3 positioned between a pair of transparent electrodes.

1 3. The variable reflectance vehicle mirror of claim 2, wherein said STN
2 liquid crystal material possesses a twist angle between approximately 180° and
3 approximately 270° between the pair of electrodes.

1 4. The variable reflectance vehicle mirror of claim 3, wherein said STN
2 liquid crystal material possesses a twist angle of approximately 210°.

1 5. The variable reflectance vehicle mirror of claim 2, wherein said STN
2 liquid crystal material further includes a cholesteric material.

1 6. The variable reflectance vehicle mirror of claim 3, wherein the surfaces of
2 the pair of electrodes facing one another each include an alignment layer positioned
3 thereon for orienting the STN liquid crystal material to its desired twist angle.

1 7. The variable reflectance vehicle mirror of claim 6, wherein the alignment
2 layers comprise a polymer material which is surface treated to provide the desired
3 orientation of the STN liquid crystal material.

1 8. The variable reflectance vehicle mirror of claim 1, wherein said STN
2 liquid crystal cell further comprises front and rear transparent plates respectively
3 positioned adjacent to outer surfaces of said electrodes.

1 9. The variable reflectance vehicle mirror of claim 8, wherein said front and
2 rear transparent plates are adhered together around their periphery to seal said STN liquid
3 crystal cell together.

1 10. The variable reflectance vehicle mirror of claim 9, further comprising
2 spacers being positioned in said STN liquid crystal material between the front and rear
3 transparent plates in order to provide a constant thickness of the space between the front
4 and rear transparent plates.

1 11. The variable reflectance vehicle mirror of claim 1, wherein the first and
2 second polarization filters are crossed polarizers.

1 12. The variable reflectance vehicle mirror of claim 3, wherein the said
2 control circuit is connected to said pair of transparent electrodes to apply a bias voltage
3 across said electrodes.

1 13. The variable reflectance vehicle mirror of claim 12, wherein the bias
2 voltage applied across said electrodes by said control circuit may be varied to vary the
3 twist angle of the STN liquid crystal material between said electrodes in order to alter the
4 reflectivity of the mirror to a desired level.

1 14. The variable reflectance vehicle mirror of claim 13, wherein said mirror is
2 controllable over a continuous range of reflectance by varying the bias voltage applied
3 across said electrodes.

1 15. The variable reflectance vehicle mirror of claim 1, wherein said control
2 circuit includes a voltage regulator capable of receiving a source of power from a vehicle
3 from between approximately 6 - 40 volts d.c. and generating a bias voltage to be applied
4 to said STN liquid cell between approximately 2.7 to 5.5. volts d.c.

1 16. The variable reflectance vehicle mirror of claim 15, wherein said voltage
2 regulator enables the mirror to be retrofit into all existing vehicles by utilizes an existing
3 power harness in the vehicle which provides approximately 6 - 40 volts d.c.

1 17. The variable reflectance vehicle mirror of claim 1, wherein said control
2 circuit is formed as a stacked IC.

1 18. The variable reflectance vehicle mirror of claim 1, wherein said control
2 circuit includes an oscillator formed within the stacked IC for variably adjusting a driving
3 frequency applied to the STN liquid crystal cell.

1 19. The variable reflectance vehicle mirror of claim 1, further comprising a
2 first photo sensor for detecting an intensity of light impinging upon said first photo
3 sensor, said control circuit being connected to said photo sensors for applying a bias
4 voltage to said STN liquid crystal cell in accordance with the intensity of the light
5 detected by said first photo sensor.

1 20. The variable reflectance vehicle mirror of claim 19, wherein the bias
2 voltage applied to said STN liquid crystal cell may be adjusted to provide a desired
3 reflectivity of light by the mirror in accordance with the detected intensity of light.

1 21. The variable reflectance vehicle mirror of claim 1, wherein said mirror is
2 formed to include a rimless outer periphery.

1 22. The variable reflectance vehicle mirror of claim 1, wherein rimless outer
2 periphery of said mirror is accomplished by trimming the stacked configuration of the
3 STN liquid crystal cell, first and second polarization filters, and reflective layer after the
4 stacked configuration is formed.

1 23. The variable reflectance vehicle mirror of claim 1, wherein the stacked
2 configuration of the STN liquid crystal cell, first and second polarization filters, and
3 reflective layer are trimmed using a water jet to fuse the edges of these layers in the
4 stacked configuration together.

1 24. The variable reflectance vehicle mirror of claim 1, wherein the mirror can
2 be controlled to adjust the level of reflectivity to a value between approximately 28% and
3 approximately 94%.

1 25. The variable reflectance vehicle mirror of claim 1, further comprising a
2 first photo sensor for detecting an intensity of a glare-causing light impinging upon said
3 photo sensor and providing a signal indicative of the intensity of the light detected, said
4 control circuit being connected to said first photo sensor for receiving the signal
5 indicative of the intensity of the light detected and applying a bias voltage to said STN
6 liquid crystal cell accordingly to control the degree of reflectivity of the mirror.

1 26. The variable reflectance vehicle mirror of claim 25, further comprising a
2 second photo sensor for detecting ambient light levels and providing a signal indicating
3 when the intensity of the ambient light detected is greater than a threshold value, said
4 control circuit being connected to said second photo sensor for receiving the signal
5 indicative of the intensity of the ambient light detected being greater than the threshold
6 value so that said control circuit disables the effect of the first photo sensor in controlling
7 the degree of reflectivity of the mirror when the ambient light detected being greater than
8 the threshold value.

1 27. The variable reflectance vehicle mirror of claim 26, wherein said first and
2 second photo sensors are directly attached to a housing for the mirror.

1 28. The variable reflectance vehicle mirror of claim 1, wherein said mirror is
2 an independently controlled interior rearview mirror for a vehicle.

1 29. The variable reflectance vehicle mirror of claim 1, wherein said mirror is
2 an independently controlled exterior mirror for a vehicle.

1 30. The variable reflectance vehicle mirror of claim 1, further comprising:
2 an anterior transparent panel adjacent to said first polarization filter; and

3 a posterior transparent panel adjacent to said reflective layer adjacent to
4 said second polarization filter.

1 31. The variable reflectance vehicle mirror of claim 30, wherein said anterior
2 transparent panel and said posterior transparent panel are comprised of glass.

1 32. The variable reflectance vehicle mirror of claim 30, wherein said anterior
2 transparent panel and said posterior transparent panel are comprised of synthetic plastic.

1 33. The variable reflectance vehicle mirror of claim 30, wherein said anterior
2 transparent panel includes at least one optically enhancing coating.

1 34. The variable reflectance vehicle mirror of claim 30, wherein said anterior
2 transparent panel includes an abrasion resistant coating formed thereon.

1 35. The variable reflectance vehicle mirror of claim 34, wherein said abrasion
2 resistant coating comprises an organo-silicone (methylpolysiloxane) polymer with a
3 thickness of approximately 2 to 10 microns.

1 36. The variable reflectance vehicle mirror of claim 30, wherein said anterior
2 transparent panel includes a hydrophilic coating formed thereon comprising zirconia and
3 silicone dioxide.

1 37. The variable reflectance vehicle mirror of claim 30, wherein at least one of
2 said anterior and posterior transparent panels includes a hydrophobic coating containing a
3 concentration of oxides and a concentration of perfluoroalkylsilane.

1 38. A variable reflectance vehicle mirror which can be controlled to adjust
2 reflectivity, wherein the variable reflectance is provided by a super twisted nematic
3 (STN) liquid crystal cell having variably controllable transmittance.

1 39. The variable reflectance vehicle mirror of claim 38, wherein the
2 birefringence of the STN liquid crystal cell is controlled to adjust the reflectivity of the
3 mirror.

1 40. The variable reflectance vehicle mirror of claim 38, wherein the
2 reflectance is continuously variable.

1 41. The variable reflectance vehicle mirror of claim 38, further comprising a
2 control circuit connected to said STN liquid crystal cell for controlling the birefringence
3 of the STN liquid crystal cell to adjust the reflectivity of the mirror.

1 42. The variable reflectance vehicle mirror of claim 38, further comprising:
2 a first polarization filter positioned on a front side of said STN liquid
3 crystal cell;
4 a second polarization filter positioned on a rear side of said STN liquid
5 crystal cell; and
6 a reflective layer positioned adjacent to said second polarization filter.

1 43. The variable reflectance vehicle mirror of claim 42, wherein said
2 reflective layer comprises an enhanced aluminum material.

1 44. A variable reflectance vehicle mirror which can be controlled to adjust
2 reflectivity, comprising:
3 a super twisted nematic (STN) liquid crystal cell having a front side and a
4 rear side;
5 a first polarization filter positioned on the front side of said STN liquid
6 crystal cell;
7 a second polarization filter positioned on the rear side of said STN liquid
8 crystal cell; and
9 a reflective layer positioned adjacent to said second polarization filter;
10 wherein the variable reflectance vehicle mirror is formed to have a rimless
11 outer periphery.

1 45. The variable reflectance vehicle mirror of claim 44, wherein the rimless
2 outer periphery of said mirror is achieved by trimming the stacked configuration of the
3 STN liquid crystal cell, first and second polarization filters, and reflective layer after the
4 stacked configuration is formed.

1 46. The variable reflectance vehicle mirror of claim 45, wherein the outer
2 periphery of said mirror is trimmed by a water jet procedure which fuses an outer
3 periphery of the various layers of said mirror together to provide a weather-resistant seal
4 around the outer periphery of said mirror.

1 47. A control device for controlling the reflectivity of a variable reflectance
2 vehicle mirror which utilizes a super twisted nematic (STN) liquid crystal cell to control
3 reflectivity, comprising:
4 a light detector for detecting an intensity of light impinging upon the
5 variable reflectance mirror; and
6 a control circuit responsive to the detected light intensity which is
7 connected to the STN liquid crystal cell for controlling the birefringence of the STN
8 liquid crystal cell to adjust reflectivity of the mirror.

1 48. The control device of claim 47, wherein said control circuit controls the
2 birefringence of the STN liquid crystal cell by controlling a bias voltage applied across
3 the STN liquid crystal cell.

1 49. The control device of claim 48, wherein the bias voltage applied across the
2 STN liquid crystal cell may be varied to vary a twist angle of molecules of a STN liquid
3 crystal material contained within the STN liquid crystal cell to alter the reflectivity of the
4 mirror to a desired level.

1 50. The control device of claim 49, wherein said STN liquid crystal material
2 possesses a twist angle between approximately 180° and approximately 270° in the STN
3 liquid crystal cell.

1 51. The control device of claim 50, wherein said STN liquid crystal material
2 possesses a twist angle of approximately 210°.

1 52. The control device of claim 47, wherein said control circuit may control
2 the reflectance of the variable reflectance mirror over a continuous range by varying the
3 bias voltage applied across the STN liquid crystal cell.

1 53. The control device of claim 47, further comprising a voltage regulator
2 capable of receiving a source of power from a vehicle from between approximately 6 - 40
3 volts d.c. and generating a bias voltage to be applied to said STN liquid crystal cell
4 between approximately 2.7 to 5.5. volts d.c.

1 54. The control device of claim 53, wherein said voltage regulator enables the
2 mirror to be retrofit into all existing vehicles by utilizes an existing power harness in the
3 vehicle which provides approximately 6 - 40 volts d.c.

1 55. The control device of claim 47, wherein said control circuit is formed as a
2 stacked IC.

1 56. The control device of claim 47, wherein said control circuit includes an
2 oscillator formed within the stacked IC for variably adjusting a driving frequency applied
3 to the STN liquid crystal cell.

1 57. The control device of claim 47, wherein the bias voltage applied to said
2 STN liquid crystal cell may be adjusted to provide a desired reflectivity of light by the
3 mirror in accordance with the detected intensity of light.

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